

found to contain a survey of Echinoderm morphology more extensive than that accorded to the morphology of other groups by the same author, as well as some useful original diagrams, such as that of Pentremites, on p. 968.

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THE STUDY OF ROCKS.

Lehrbuch der Petrographie. Von Dr. Ferdinand Zirkel, Ord. Professor der Mineralogie und Geognosie an der Universität Leipzig. Zweite gänzlich neu verfasste Auflage. Three vols. 8vo. Pp. 2619. (Leipzig: Engelmann, 1893-94.)

THE appearance of a second edition of Prof. Zirkel's admirable "*Lehrbuch der Petrographie*" is an event of no little importance in the history of geological science. The part played by the author of this work in developing the methods of microscopic analysis, as applied to rocks, is too well known to require recapitulation in this place, and the long series of petrographical memoirs with which he has enriched geological literature—dealing with the rocks of the North American as well as with those of the European continent—are familiar to all students. While a great number of works treating of the microscopic study of rocks (including the author's own "*Die mikroskopische Beschaffenheit der Mineralien und Gesteine*") have appeared during the twenty-eight years which have elapsed since the first edition of the "*Petrographie*" was published, there is not one among them that quite occupies the place of that excellent treatise—with its wealth of information on the history and development of petrographical nomenclature.

The rapidity of growth of this branch of geological science during the past thirty years, is brought out in a very striking manner by a comparison of the first and second editions of this standard work. The first edition consisted of two thin volumes with an aggregate of 1241 pages; the second edition forms three bulky volumes with 2619 pages. But this is not all: it is evident to any one who peruses these volumes, that, in spite of the employment of more than double the number of enlarged pages, with much small type introduced, the author has found it impossible to discuss in all their aspects the views of previous authors with the completeness and comprehensiveness that were so remarkable in the first edition of the book. The student may be satisfied that Prof. Zirkel has overlooked little or nothing of importance in the literature of his subject; but, not unfrequently, it will be noticed that in his attempt to deal as concisely as possible with this vast mass of literature, he has made statements with respect to the views of the authors quoted, which are scarcely borne out by a reference to the memoirs themselves. While, therefore, this new edition will be invaluable in supplying ample references to petrographical literature, it will not in any way obviate the necessity of consulting the original memoirs.

As indicating the fulness with which the subject is now treated, we may mention that the number of pages dealing with "*General Petrography*" has increased from 171 to 634. The account given of the optical properties of minerals and of the structure of rocks, as made out by the aid of the microscope, is naturally responsible for a large part of this increase; the description of the

common rock-forming minerals, which was comprised in forty pages in the first edition, now requiring no less than 291 pages. The greatest defect in this part of the work will be found in the absence of illustrations. Of this the author is fully sensible, as will be seen from a reference to his preface; but, as he justly pleads, the addition of illustrations could not fail to add to the bulk and cost of a book that has already grown to encyclopædic dimensions.

Every student of geology will naturally examine the work with the desire to learn what are the present views of so great an authority as Prof. Zirkel on the vexed subject of rock-classification and nomenclature. In the first edition of the book, our author, following the plan of most German writers upon the subject, attempted to class rocks according to their structure and mineralogical constitution, quite irrespectively of their origin, into simple crystalline rocks (ice, rock-salt, quartz-rock, limestone, &c.), compound crystalline rocks of granular and schistose character respectively, and clastic, or fragmental, rocks. In the second edition, he departs from this method, and commences the descriptive portion of the book with an account of the "*Massige eruptive Erstarrungsgesteine*," which occupies no less than 1292 pages. This is followed by an account of the "*Krystallinische Schiefer*" (275 pp.), the "*Krystallinische oder nicht-klastische Sedimentgesteine*" (230 pp.), and the "*Klastischen Gesteine*" (125 pp.). It will thus be seen that the primitive classification into crystalline (simple and compound) rocks and clastic rocks, has been abandoned for one in which account is taken of their mode of origin.

In dealing with the great class of igneous rocks, Prof. Zirkel has also introduced some modifications of his original method. In 1866, he grouped these rocks, according to the nature of the alumino-alkaline silicate present in them, into Orthoclase-rocks, Oligoclase-rocks, Nepheline- and Leucite-rocks, Labradorite-rocks, Anorthite-rocks, and rocks without feldspathic constituents. The obvious objections to this classification were: (1) That many rocks contain several distinct species of feldspar, notably in their porphyritic constituents, and in their groundmass respectively; and (2) that geologists possess no simple, infallible, and easily applied test for ascertaining the exact species of feldspars present in rocks. In 1873 (in his "*Mikroskopische Beschaffenheit der Mineralien und Gesteine*"), Prof. Zirkel abandoned this classification for the simpler division of feldspar-bearing rocks into Orthoclastic and Plagioclastic. This classification, which is facilitated by the general presence of twin striation as an easily recognised distinction of the plagioclases, has now been very generally adopted by petrographers. In the work before us, however, the author divides the feldspar-bearing igneous rocks into two series, distinguished by the predominance of an "alkali feldspar" or of a "soda-lime feldspar" respectively. It does not appear to us that anything is gained by this new departure, which will compensate for the admitted difficulty of applying the test for the discrimination of the two classes. Another change in classification which will interest English readers is that, while the separation of volcanic rocks into two series, the pre-tertiary (palæo-volcanic) and

post-tertiary (neo-volcanic) is maintained, the Plutonic rocks are admitted to be of all ages.

Geologists will, alas, look in vain in this work for any indication that they may hope for a speedy termination of the terrible confusion that has so long prevailed with respect to petrographical nomenclature. On the contrary, they will find that in addition to having to reckon with the schools of Paris and Heidelberg, as they have done in the past, they will now have to take account of a third—that of Leipzig! With some of Prof. Zirkel's criticisms of contemporary palæontological literature, English and American geologists will heartily sympathise. The employment of such terms as granite, granophyre, &c., with significations different from those given to them by the authors of the names, cannot but fail to lead to almost endless confusion, and we are glad to see that the authority of Prof. Zirkel is thrown into the scale against such principles of nomenclature being adopted; but in other cases we cannot but think that his objections to the nomenclature of other authors are not likely to be sustained by future workers in this branch of science.

Whether the confusion that now exists can be removed by any friendly discussion between the representatives of rival schools—such as those of the international committee proposed at the late Geological Congress at Zurich—time alone can show. If this be impossible, and writers in France and Germany, respectively, continue to ignore the terminology employed in other countries than their own, then it appears to us that, if science is to maintain her cosmopolitan character, only one method of escape is possible. We must follow the example of the other natural-history sciences in adopting the test of *priority* as absolute and final in our terminology of rocks. That many inconveniences must result from such a course may be readily admitted; and it will not be easy to fix upon the Linnæus of our science—or to decide upon the date at which exact petrographical literature may be supposed to have commenced. But almost any trouble and difficulty of this kind is worth encountering, if we may hope that geologists in the future will, in speaking of rocks, attain that great desideratum of “one thing—one name.”

In the meanwhile, we are not ungrateful to the author of the work before us for the enormous labour and pains he has taken in wading through the great mass of petrographical literature; in furnishing us with correct statements concerning the origin and history of terms; and in placing on record the decisions he has arrived at upon many of the difficult problems that confront us. The “Lehrbuch der Petrographie” has always been a standard work of reference; and, in its new form, it has become more indispensable than ever. J. W. J.

OUR BOOK SHELF.

Pithecanthropus Erectus, eine Menschenaehnliche Uebergangsform aus Java. By E. Dubois. 4to, pp. 40, illustrated. (Batavia, 1894.)

JAVA, from its geographical situation, being just one of those countries where the remains of a connecting form between man and the higher apes would be extremely likely to occur, zoologists have naturally been attracted by the title of the work before us, which proclaims in no

uncertain tones that such a missing link has actually been discovered. A feeling of disappointment will, however, probably come over the student, when he finds how imperfect are the remains on the evidence of which this startling announcement is made; and when he has submitted them to a critical examination, he will probably have little difficulty in concluding that they do not belong to a wild animal at all. The specimens described are three in number, and were discovered in strata of presumed Pleistocene age near a spot called Trinil. The first of these is a last upper molar tooth, found during the drying-up of a river-bed in the autumn of 1891. A month later, the roof of a large cranium was discovered in the same bed, at a distance of only about a yard from the spot where the tooth laid. Finally, in August 1892, at a distance of some sixteen yards higher up the stream, a left femur was disinterred, which is stated to present much more human resemblances than either of the other two specimens. The bed from which this bone was derived is stated to have been the same as that from which the other two specimens were obtained. The author is confident that all are referable to a single animal; and we are content to accept this view.

Especially stress is laid on the femur as indicative of human affinities; and here again we are in agreement with the author, only we would go one step further, and say that it actually is human. As is pointed out in the text, this bone has a large exostosis below the lesser trochanter; and we believe that such slight differences as it shows from normal human femora, are due to this diseased condition. With regard to the skull, which shows a marked human facies, but an extremely small development of the brain-cavity, the absence of ridges on the calvarium clearly shows that it can belong to no wild anthropoid; and there appears every reason to regard it as that of a microcephalous idiot, of an unusually elongated type. The molar, so far as we can see from the figure, may likewise perfectly well be human.

Haeckel's “*Pithecanthropus*” may, therefore, be relegated to the position of an hypothetical unknown creature for which it was originally proposed; while the specific name “*erectus*” must become a synonym of the frequently misapplied “*sapiens*.” R. L.

The Planet Earth. An Astronomical Introduction to Geography. By R. A. Gregory, F.R.A.S. (London: Macmillan and Co., 1894.)

It is, perhaps, one of the consequences of the antiquity of astronomy that it is not now usually presented to the youthful mind in a thoroughly scientific manner. The established truths of the science, in so far as they concern the earth's place as a planet, though once so astounding to mankind, are now so commonplace that the educational advantages of a study of the phenomena which brought them to light are frequently overlooked altogether. As in the case of geography, information rather than education appears to be the principal aim of astronomical teaching when it is not carried beyond the elementary stage which it reaches in schools; although, when properly handled, there is no subject better calculated to lead the mind into a scientific groove.

We therefore cordially welcome this attempt to indicate the lines which should be followed for a profitable study of that portion of astronomy which deals with the earth as a planet. The bald statements as to the earth's dimensions and movements, so frequently appearing in the text-books of geography, furnish the sole astronomical knowledge which many acquire; but they are, as Mr. Gregory remarks, quite inadequate. The design of the little book before us, is first to direct the students' attention to observations which they may generally make for themselves, and then to show how such phenomena can be accounted for. Thus,